INTERSPIRO

96708G01

USER MANUAL

DIVATOR DP1 SURFACE SUPPLY

EC Type-examination (Directive 89/686/EEC) by SGS Yarsley ICS Ltd., Weston-super-Mare, BS22 OWA (Notified Body No 0120).

The DIVATOR DP1 Surface Supply will be approved for a range of 0-50 meters (0-164 feet) depth and for cold water temperatures down to 4 ± 2 °C (39,2 ± 3,6 °F) in accordance with EN 250.

The DIVATOR DP1 Surface Supply has been successfully tested for cold water -1,7 °C (29 °F) use to a depth of 60 meters (198 feet) of sea water by the United States Navy Experimental Diving Unit NEDU (Panama City FL).

The DIVATOR DP1 Surface Supply together with DIVATOR MIL has been certified in accordance with prEN 15333-1 as a unit.

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SAFETY NOTE

WARNING!

BEFORE USING THE DIVATOR DP1 SURFACE SUPPLY THE USER MUST HAVE RECEIVED FULL TRAINING IN ITS USE, HAVE READ AND UNDERSTOOD THIS USERS MANUAL AND DEMONSTRATED PROFICIENCY TO A RESPONSIBLE TRAINER OR SUPERVISOR. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH FOR THE USER AND CAN HAVE SERIOUS CONSEQUENCES FOR PEOPLE TO BE RESCUED AND ITEMS OF VALUE TO BE SAVED.

• This manual contains hazard indicators concerning some of the risks and dangers potential while using the Divator System. These different types of hazard indicators correspond to the degree of hazard you may encounter:

DANGER!

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION!

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It may also be used as a warning against unsafe practices.

Failure to comply with the instructions highlighted by the hazard indicators may result in the equipment not functioning properly, serious injury or death.

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DANGER! All users of the DIVATOR SYSTEM must be certified by a nationally or internationally recognized SCUBA certification agency. Furthermore, all users of the DIVATOR SYSTEM must be adequately trained in its use by a certified SCUBA instructor with thorough knowledge and experience in the use of the DIVATOR SYSTEM.

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WARNING! High pressure systems must always be handled with care. In some cases damage to high pressure parts may result in injury or death. Interspiro will not be liable for damages incurred as a consequence of failure to follow the instructions in this manual.

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WARNING! Before using the DIVATOR SYSTEM, the user must ensure that the system has been properly inspected and maintained. (see chapter 6 Maintenance and Testing Schedule, chapter 7 Maintenance).

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WARNING! All users of the DIVATOR SYSTEM must periodically undergo training of appropriate Emergency Procedures in shallow water to maintain preparedness in the event an actual emergency should occur.

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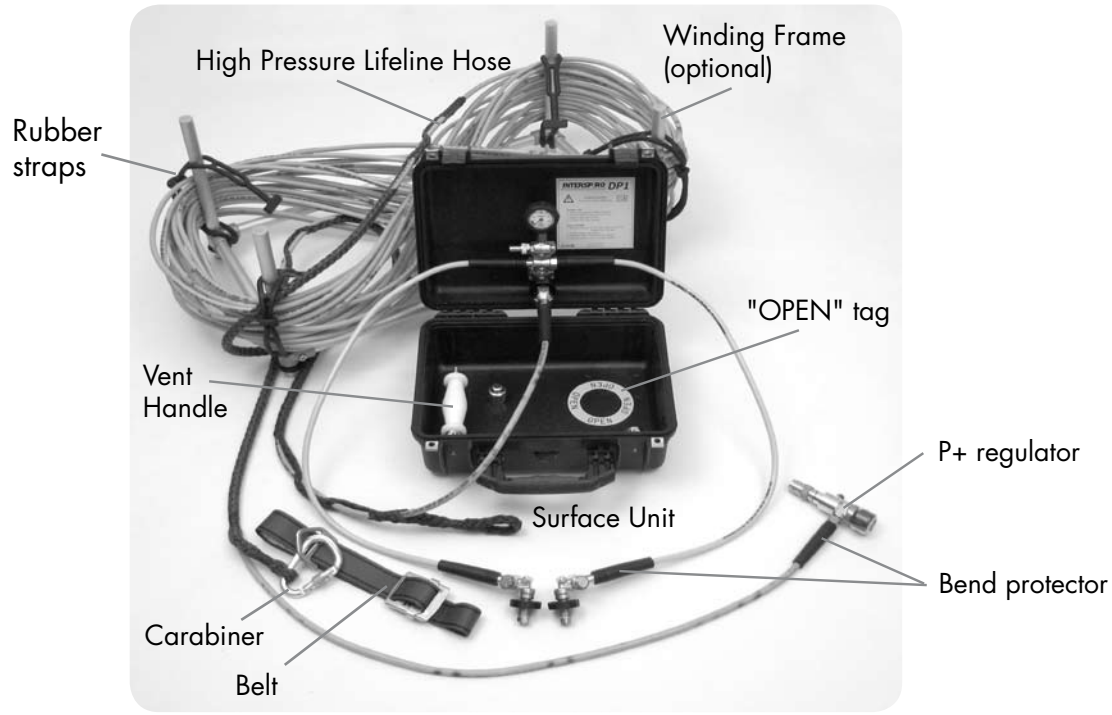
1 TECHNICAL DESCRIPTION

1.1 DIVATOR DP1 SURFACE SUPPLY

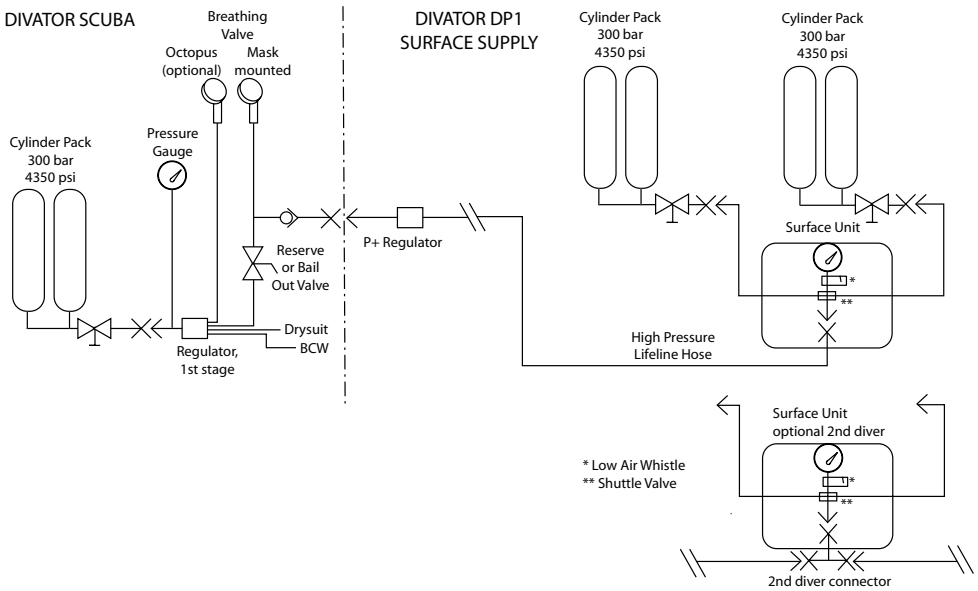
DIVATOR DP1 Surface Supply features a unique patented supply hose and a surface supply dive control panel enabling rapid deployment in remote locations. Divator DP1 is a surface supply diving system with an operating pressure of up to 300 bar (4350 psi).

DIVATOR DP1 has two high-pressure supply cylinder connections, each are connected to a high pressure supply cylinder or cylinder pack. A shuttle valve allows the attendant to change the supply cylinder or cylinder pack during the diving operation.

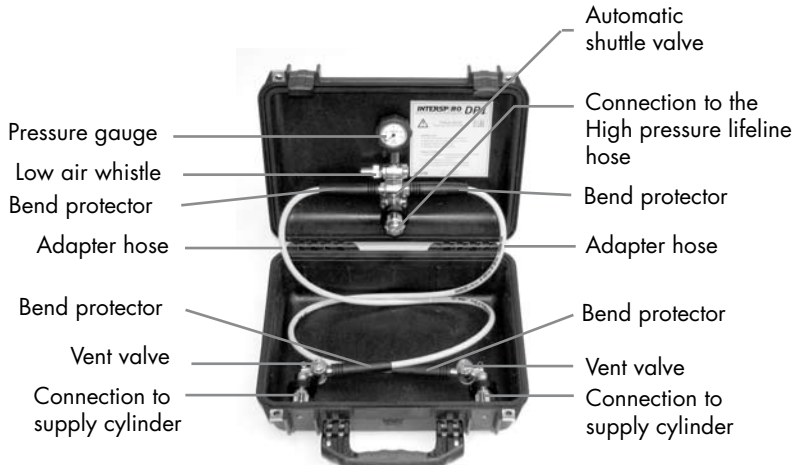
The Divator DP1 Surface Supply consists of:



1.2 SYSTEM SCHEMATICS



1.3 SURFACE UNIT



DIVATOR DP1 comprises an automatic shuttle valve, low air warning whistle, pressure gauge, adapter hoses for air supply cylinders and a connection to the high pressure lifeline hose for the diver. The connections to the air supply sources are suitable for both 200 and 300 bar (2900 and 4350 psi) pressure "DIN" fittings.

The following accessories are included with the DP1 Divator Surface Supply:

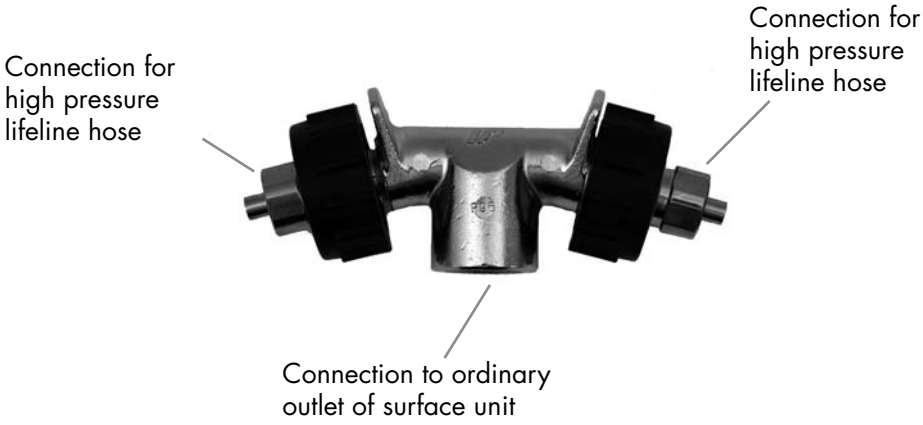
- "OPEN" tag — Used to identify which air supply cylinder that is currently in use.
- Vent handle — Used for protection of the high pressure lifeline hose ends when stowing, for flushing the high pressure lifeline hose with fresh air before diving and for rapid venting of the high pressure lifeline hose after diving.
- Carbine hook — Used to anchor the high pressure lifeline hose to the belt.
- Belt — Used for ergonomic attachment of the high pressure lifeline hose to the diver.

When the supply pressure falls to 55 bar (800psi), the warning whistle sounds and the air supply source must be changed by opening the unused supply cylinder.

The shuttle valve automatically switches to the higher pressure cylinder, sealing off the previously used supply cylinder, this enables the recently used adapter hose to be vented and the supply cylinder to be replaced.

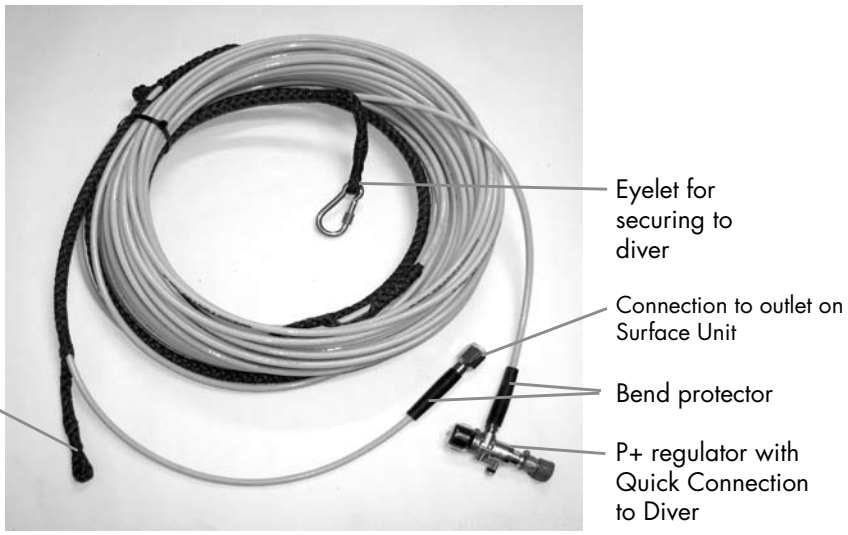
The pressure gauge displays the pressure of the cylinder currently in use.

1.3.1 DIVATOR DP1 SURFACE SUPPLY ADAPTER FOR TWO DIVERS


Connection for high pressure lifeline hose
Connection for high pressure lifeline hose
Connection to ordinary outlet of surface unit

With the adapter for two divers (optional) the Divator DP1 is enabled to supply air for two divers simultaneously, as with the version for one diver, these divers will have a surface supply unit that is self-compensating for depth variations. The unit will also have the advantage that it is possible to have two divers at different depths, using the same cylinder supply source.

1.4 HIGH PRESSURE LIFELINE HOSE


Eyelet for securing to diver
Connection to outlet on Surface Unit
Bend protector
P+ regulator with Quick Connection to Diver
Eyelet for securing at surface

The Divator DP1 Surface Supply has been approved with an air supply hose up to 120 meters (396 feet) in length for a maximum depth of 50 m (164 feet).

The high pressure lifeline hose is attached to the diver with a quick-connection on the P+ regulator, it attaches to the diver's manifold on the Divator regulator . The quick-connection has a locking ring and should be secured when diving.

The other end of the high pressure lifeline hose is attached to the surface unit with a "DIN" coupling that is tightened by hand. The pressure in the high pressure lifeline hose varies between 300–0 bar (4350–0 psi), depending on the air supply pressure.

1.4.1 HIGH PRESSURE LIFELINE HOSE

The high pressure lifeline hose has relieving loops and bend protectors at both ends, these protect the hose couplings from stress and make it possible to use the hose as a life line.

The diver and attendant are both responsible for securing the high pressure lifeline hose. Assure that the high pressure lifeline hose does not get kinked or severely bent . This is very important and must be carefully checked.

The maximum work pressure of the hose is 300 bar (4350 psi) and the burst pressure exceeds 1500 bar (21760psi).

The tension load for the high pressure lifeline hose is minimum of 9000 N (900 kg or 2000 lbs).

The connection nipples at the hose ends can take a straight load of minimum 3000 N (300 kg or 600 lbs).

The high pressure lifeline hose is designed and tested in accordance to requirements for lifelines and can therefore act as a safety lifeline.

The high pressure lifeline hose including relieving loops, hose, belt and carabine hook can hold tensions that can be created during normal operational diving.

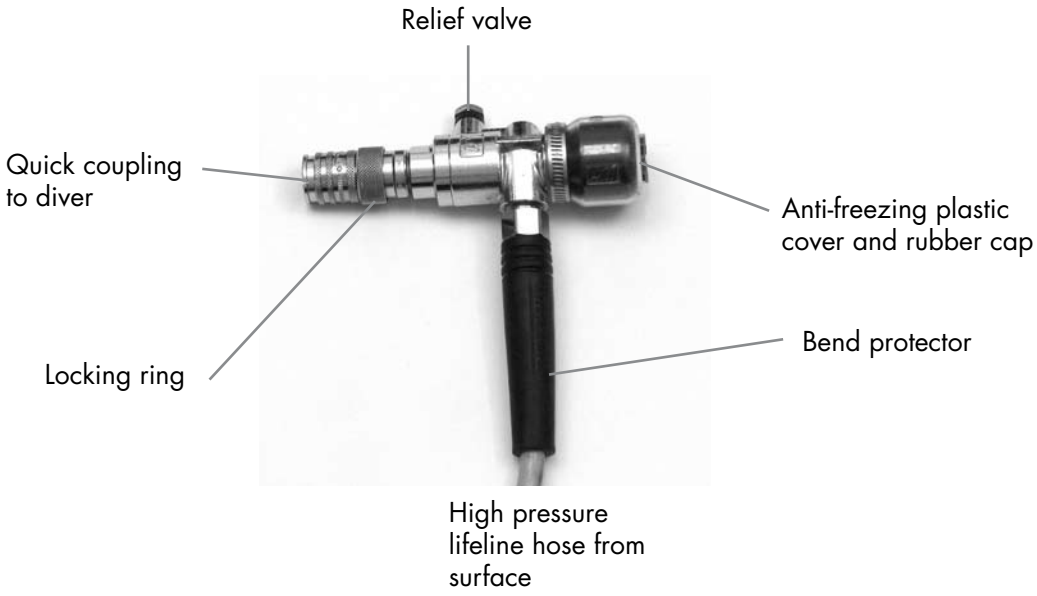
If the high pressure lifeline hose has endured exceptional carrying loads more than 1000 N (100 kg or 220 lbs) it must be replaced.

It is normally not possible to exceed a load of 1000 N (100 kg or 220 lbs) with hand power (i.e. pulling by hand).

1.4.2 REGULATOR, P+

The P+ Regulator is attached to the end of the high pressure lifeline hose and is connected to the divers regulator. The P+ regulator will supply the diver with a higher secondary pressure 10±0.3 bar (145±4.4 psi) than the regulator used for the DIVATOR SCUBA cylinder.

The P+ regulator will automatically compensate the secondary pressure for depth variations done by the diver and no continuous adjustment is needed by the surface attendant.



The regulator is equipped with a relief valve in the event there is a malfunction increasing the secondary pressure. The cracking pressure is 16–18 bar (230–260 psi).

1.5 DIVATOR REGULATOR OPTIONS

The DIVATOR REGULATOR is available in two versions. The standard version is the DIVATOR Regulator with Reserve Valve. This version provides an active breathing resistance warning when the SCUBA cylinder pressure reaches the reserve pressure of 65 bar (942 psi). This warning is provided in both the SCUBA and DP1 Surface Supply configurations.

The optional version is the DIVATOR Regulator with Bail Out Valve. This version provides an active breathing resistance warning only in the DP1 Surface Supply configuration when surface supply pressure is lost.

The following is an overview of the available regulator options and their characteristics.

	SCUBA		**SURFACE SUPPLIED SCUBA**	
REGULATOR TYPE	Active Warning	Passive Warning	Active Warning	Passive Warning
Divator Regulator with Reserve Valve (standard)	65 bar / 942 psi SCUBA cylinder pressure	Pressure Gauge	65 bar / 942 psi SCUBA cylinder pressure	Pressure Gauge
Divator Regulator with Bail Out Valve** (optional)	None *	Pressure Gauge	Loss of Surface Supply	Pressure Gauge

** Visible active warning can be added by using the Interspiro Divator HUD.*

*** The DIVATOR Regulator with Bail Out Valve is intended for applications where the diver needs completely full SCUBA cylinders for his ascent, when he experiences a loss of surface supply air.*

The Interspiro Bail Out regulator is not recommended for use in SCUBA (without surface supply) dives because it does not provide an active warning when the diver's SCUBA cylinders have reached the reserve pressure level. The optional Divator HUD provides a visible active warning that the SCUBA cylinders have reached reserve pressure.

1.5.1 DIVATOR REGULATOR WITH RESERVE VALVE

This is the standard regulator for use with both the SCUBA and DP1 Surface Supply configurations.

The diver gets an active breathing resistance warning when approximately 20 % of the SCUBA cylinder air supply remains 60-70 bar (870-1015 psi). The warning occurs on the high end of this pressure range when the air consumption rate is high. The breathing resistance warning is created by reducing the air supply at the end of each inhalation. The inhalation phase will be shorter and shorter and will be repeated a number of times until the valve becomes completely closed or until the reserve valve lever is actuated (pushed down). When actuated the reserve valve lever will be locked in the open position (down) thereby shutting off the breathing resistance warning and making the reserve air volume available to the diver.

It is not possible to inadvertently or prematurely activate (push down) the reserve valve lever; it will automatically reset itself (up position) until the air supply pressure has dropped to approximately 80 bar (1160 psi).

When using the DIVATOR DP1 Surface Supply, all supply air will be taken from the DIVATOR DP1 Surface Supply as long as the DP1 Surface Supply pressure is greater than 20 bar (290 psi) at a dive depth of 50 meters (150 feet) or less. Note: The DIVATOR DP1 Surface Supply has a low air warning whistle that is activated at 55 bar (790 psi).

When using the DIVATOR DP1 Surface Supply, if the surface air supply is interrupted air will be taken from the diver's SCUBA cylinders. The diver will receive active breathing resistance warning when the DIVATOR SCUBA cylinder pressure has dropped to approximately 65 bar (940 psi).

1.5.1 DIVATOR REGULATOR WITH BAIL OUT VALVE

This regulator is identified with a yellow "Bail Out" tag on the high pressure gauge hose. The Divator Regulator with Bail Out Valve warns the diver when the supply from the surface is interrupted. This is a feature that can be required for decompressions that require more air than might be available when using the standard Regulator with Reserve Valve.

While diving with the DIVATOR Regulator with Bail Out Valve and connected to the DIVATOR DP1 Surface Supply, the Bail Out Valve lever should be in the upwards position. If the surface supply is interrupted, the diver will receive an active breathing resistance warning and must then actuate (push down) the lever in order to switch to the SCUBA cylinders air source. When actuated (pushed down), the Bail Out valve lever will be locked in the down position.

It is possible to push down the lever of the Bail Out Regulator prior to active breathing resistance warning ; however, this action does not switch to the DIVATOR SCUBA cylinder air Supply as long as there is pressure from the DIVATOR DP1 Surface Supply. Note: the lever will not reset automatically like the Standard Regulator with Reserve Valve version.

CAUTION! Always ensure that the Regulator Bail Out Valve lever is in the up position prior to and during surface supply diving.

2 PRE-DIVE PROCEDURES

2.1 HIGH PRESSURE LIFELINE HOSE HANDLING

To avoid kinking of the supply high pressure lifeline hose it is important to wind the hose in such way that it is free from twisting (kinks). Kinks can result in flow restrictions.

The high pressure lifeline hose should be wound up pressurized in figures of eight with a diameter greater than 500 mm (> 1.5 feet) for each turn.

The diving attendant, or other responsible person, must ensure that the high pressure lifeline hose is handled in a way to reduce any possible twisting (kinking) of the high pressure lifeline hose.

NOTE: The first time a high pressure lifeline hose is used it can twist about four turns when its pressurized. Therefore unwind the high pressure lifeline hose and stretch it out to it's full length. Pressurize the high pressure lifeline hose to a minimum of 50 bar (725 psi) and wind it in the correct way. Release the pressure. Secure the high pressure lifeline hose with rope or straps to hold it together during handling and transport.

2.2 WINDING FRAME

Using a winding frame simplifies the winding of the high pressure lifeline hose considerably.

The Winding Frame consists of four poles to wind the high pressure lifeline hose around in the figures of eight.

The high pressure lifeline hose should be wound up pressurized in figures of eight with a diameter greater than 500 mm (> 1.5 feet) for each turn.

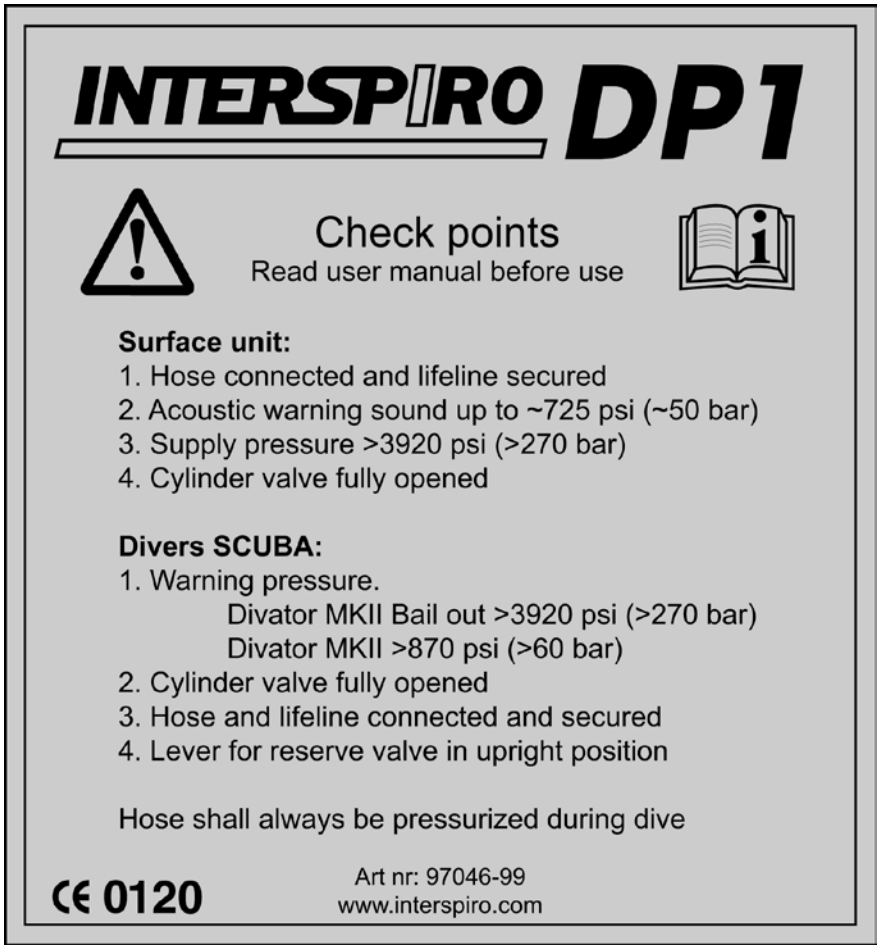
When the high pressure lifeline hose has been wound onto the winding frame and the pressure in the hose has been released, it should be secured with the supplied rubber straps to hold it in place during handling and transport.

The ends of the high pressure lifeline hose should always be protected from water and dirt. Therefore always connect the ends of the lifeline hose to the supplied vent handle and make sure not to sharply bend the lifeline hose.

3 OPERATING PROCEDURES

3.1 CHECK LIST

The checklist below can be found on the inside lid of the Surface Unit.


INTERSPIRO DP1
Check points
Read user manual before use
Surface unit:
1. Hose connected and lifeline secured
2. Acoustic warning sound up to ~725 psi (~50 bar)
3. Supply pressure >3920 psi (>270 bar)
4. Cylinder valve fully opened
Divers SCUBA:
1. Warning pressure.
Divator MKII Bail out >3920 psi (>270 bar)
Divator MKII >870 psi (>60 bar)
2. Cylinder valve fully opened
3. Hose and lifeline connected and secured
4. Lever for reserve valve in upright position
Hose shall always be pressurized during dive
CE 0120
Art nr: 97046-99
www.interspiro.com

3.2 SURFACE ATTENDANT OPERATING PROCEDURES

1. Open the surface unit box. Place the box in such a position so that the pressure gauge is easy to observe.
2. Check that the high pressure lifeline hose is correctly wound from the last dive (see instructions in the section *Pre Dive Procedures)*.
3. Visually inspect the o-ring seals on the adapter hose cylinder connectors and on the surface unit connection to the high pressure lifeline hose. If they show signs of damage or they are missing, replace with new ones.
4. Connect the high pressure lifeline hose to the surface unit.
5. Secure the high pressure lifeline hose in a safe way to a fixed object.
6. Connect one adapter hose to an air supply cylinder.
7. Connect the second adapter hose to a second air supply cylinder.
8. Close the vent valves on the adaptor hoses.

9. Open one cylinder valve. Check that the audible alarm sounds, and that the alarm stops after a short period when the pressure increases. Check for leaks. Make a note of the pressure in the first cylinder.
10. Close the first cylinder valve and open the vent valve to release the pressure. Close the vent valve.
11. Open the other cylinder valve. Check for leaks. Make a note of the pressure in the cylinder. Tag the open valve with the "OPEN" tag.
12. Check that the pressure in the cylinder as shown on the gauge is sufficient to start your diving operation.
13. Connect the vent handle to the P+ regulator and flush the hose with fresh air.

When the diver has completed his preparations, check the following:

11. Check that the cylinder valve on the DIVATOR SCUBA supply cylinder is completely open.
12. Check that the high pressure lifeline hose is secured and correctly fastened to the divers belt.
13. Check that the P+ regulator with quick connector is correctly connected and locked with the locking ring.
14. Check that the handle on the reserve valve is in the upright position.
    Or for Divator MKIII in the C (closed) position.

3.3 DIVER OPERATING PROCEDURES

1. Prepare the DIVATOR SCUBA according to the instructions in the DIVATOR SCUBA User Manual.
2. Open the cylinder valve on the DIVATOR SCUBA.
3. Check that the DIVATOR SCUBA cylinder pressure is greater than 270 bar (3920 psi). Close the cylinder valve and breathe from the unit until the reserve valve becomes active as earlier described.

   For Divator MK II Bail Out, or MKIII: check that the pressure in the cylinder is at least 270 bar (3920 psi)
4. Open the reserve valve by bringing down the lever and confirm that you can breathe the reserve air.
5. Check that the high pressure lifeline hose is pressurized. Connect the quick coupling on the P+ regulator to the Divator manifold and secure it with the locking ring.
6. Connect the eyelet (carbine hook) on the high pressure lifeline hose to your belt.
7. Open the cylinder valve on the Divator MK II or Divator MK II Bail Out.
8. Check that the reserve valve is in the upright position when the dive begins.

During the diving operation the surface attendant must observe the following:

- Check the pressure on the surface unit gauge frequently.
- Check frequently that the high pressure lifeline hose does not kink.
- Be ready to switch to the second air supply cylinder when the surface unit gauge reaches 55 bar (790 psi), or when the audible alarm sounds.
- If necessary, plan for connection of further air supply cylinders.

WARNING! If the high pressure lifeline hose is connected to the diver and dived without being pressurized the water pressure may become higher than the air pressure on the inside of the hose and may partially fill the inside of the hose with water. If the surface attendant then realizes his fault and pressurizes the hose, water could be supplied to the diver instead of air.

WARNING! If the high pressure lifeline hose ever enters the water not pressurized there is the possibility of water entering the hose.

WARNING! A pressurized high pressure lifeline hose is not to be connected to a diver under water under normal circumstances. See Warning above.

4 EMERGENCY PROCEDURES

4.1 LOW AIR SUPPLY PRESSURE, SURFACE

In an emergency the surface supply can be used until the air supply pressure has dropped to approximately 20 bar (290 psi).

WARNING! The high pressure lifeline hose should never be re-pressurized during the dive if the pressure in the hose has been lower than 10 bar (145 psi). Water may enter into the hose when depressurized and submerged, as stated earlier!

4.2 SURFACE SUPPLY FAILURE, DIVER

- If the diver has insufficient or no surface air supply, immediately change to bail out supply by actuating the reserve valve lever.
- After actuating the reserve valve lever, abort dive! Start ascending towards the water surface.

5 POST DIVE PROCEDURES

1. Wind the high pressure lifeline hose according to the instructions in section *Pre-Dive Procedures*.
2. Close the air supply cylinders valves and the cylinder valve on the bail out cylinder.
3. Depressurize the Divator DP1 Surface Supply by gently opening the vent valves on the adapter hoses. To depressurize faster, use the purge button on the breathing valve or use the pressure vent handle.

WARNING! When using the pressure vent handle, hearing protection should be used.

4. Disconnect the adapter hoses and park them in their parking connections.
5. Disconnect the high pressure lifeline hose and connect both ends of the hose to the vent handle. Make sure the lifeline hose is not sharply bent.
6. Check that the high pressure lifeline hose with couplings are free from damage, mud and chemicals.

6 MAINTENANCE AND TESTING SCHEDULE

This schedule is only valid for Divator DP1 diving equipment.
The schedule shows the minimum requirements for maintenance and testing as recommended by Inters
Local requirements may differ due to environmental conditions and frequency of use.
To ensure trouble free operation, it is essential that all parts that are included in the preventive maintena
shall be replaced in accordance with the schedule below.

#	APPARATUS/COMPONENT	BEFORE USE	AFTER USE	EVERY YEAR	EVERY 6TH YEAR	
1	**Hose-Life Line**	U	C	C T	C T	
1.1	Hose			I	M [4]	
1.2	Strain Relief			I	I	
1.3	Belt & Carabine Hook			I	I	
1.4	Coupling			I	I	
1.5	P+ Regulator			I	M [3]	
2	**Surface Unit**	U	C	C T	C T	
2.1	Box			I	I	
2.2	Manifold Block			M [1]	M [2]	

I = **Inspection**
C = **Cleaning**
U = **User Test**
M = **Preventive Maintenance**
T = **Performance Tests**

1 Preventive Maintenance kit for Divator DP1, Surface Pa
Ordering number: 460 190 701

2 Preventive Maintenance kit for Divator DP1, Surface Pa
Ordering number: 460 190 702

3 Preventive Maintenance kit for Divator DP1, P+ Regula
Ordering number: 460 190 703

4 The hose shall be replaced every 6th year.
For ordering number, see spare part list.

7 MAINTENANCE

7.1 CLEANING

1. Clean the hose, belt and carbine hook with a cleaning solution consisting of 10 % soap and fresh water.
2. A degreasing agent can be used to clean badly polluted parts. Before using such agent contact the manufacturer of it to check if it is suitable in combination with the type of materials used in Divator DP1 Surface Supply. Follow the instructions received from the manufacturer.
3. Mechanical parts must be carefully cleaned so that sand or dust are removed from the moving parts.

NOTE! Remember to keep the surface supply pressurized when washing in soap and water.

7.2 LEAKAGE TEST

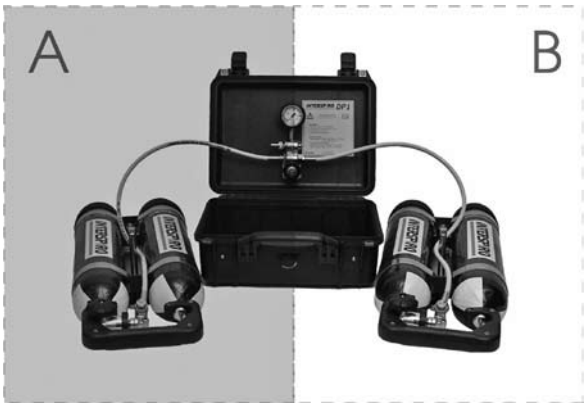
The leakage of hoses and couplings is checked by pressurizing them and checking that the pressure is maintained (maximum pressure drop 1 bar/min (15 psi/min)).

If any part fails the leakage test. Replace the part with Interspiro original parts.

Preparation:

Prepare two air cylinders filled to the same pressure, but at least 250 bar (3630 psi).

1. Connect the high pressure lifeline hose to the surface unit.
2. Connect the adapter hoses to the cylinders but leave both vent valves open.



A and B in the following text refers to the A and B side of this image.

On the A side:

2. Close the vent valve.
3. Open cylinder valve.
4. This pressurizes the high pressure lifeline hose and adaptor hose on A side.

5. Listen for leaks along the length of the high pressure lifeline hose including P+ regulator and adaptor hose. It may be necessary to use leak spray or soap water solution to detect leakage.
6. Pay close attention that leakage is not coming from the shuttle valve housing or whistle.
7. Close cylinder valve.

On the B side:

8. Close vent valve.
9. Open cylinder valve. This pressurizes the adaptor hose on the B side.

On the A side.

10. Open vent valve, relieve pressure and leave open.
11. Listen that the shuttle valve changes over. (This occures during step 10 or step 9 above).

On the B side.

12. Listen for leakages from B side adapter hose and shuttle housing.
13. Close cylinder valve.
14. Open vent valve and relieve the pressure.
15. Disconnect adapter hoses and high pressure lifeline hose.

7.3 REGULAR MAINTENANCE

- The eyelets at the ends of the high pressure lifeline hose must be regularly inspected to ensure that no damage or chemical deterioration exists.
- Check the quick connect coupling on a regular basis.
- Check that the locking sleeve on the quick connect coupling is easily operated, and that it is free from sand and dust.
- Inspect all hoses on a regular basis. If there is any suspicion of chemical or mechanical damages (such as overload) a full inspection is required.
- Disassemble the anti-freeze plastic cover and rubber cap on the P+ regulator to inspect if there is water inside or if the rubber cap is damaged. Clean and dry carefully before reassembly.
- The rubber cap shall be mounted on the larger diameter grooves and the plastic cover on the smaller diameter.
- Carefully tighten the clamp for the plastic cover. A correctly assembled cover is easy to rotate.
- Check that the rubber ring on the P+ regulator relief valve does not have any deformations.
- Regularly check that the high pressure lifeline hose is correctly wound and that there are no twists.
- Dry all components of Divator DP 1 Surface Supply before long time storage for. Storage should be in a dark and dry place.

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